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CE notification

The PCI-1723, developed by ADVANTECH CO., LTD., has passed the CE test for environmental specifications when shielded cables are used for external wiring. We recommend the use of shielded cables. This kind of cable is available from Advantech. Please contact your local supplier for ordering information.

On-line Technical Support

For technical support and service, please visit our support website at:
<http://www.advantech.com/support>

Note:

- ⌘ Concerning the environment protection, we'd like to reduce the paper using for the user's manual. Starting the page of *Appendix C*, please find the PDF file of the CD-ROM.
-

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Contents

1. INTRODUCTION	1
1.1 FEATURES	1
1.2 APPLICATIONS	3
1.3 INSTALLATION GUIDE.....	3
1.4 SOFTWARE OVERVIEW.....	5
1.5 DEVICE DRIVERS PROGRAMMING ROADMAP	6
1.6 ACCESSORIES	8
2. INSTALLATION	9
2.1 UNPACKING.....	9
2.2 DRIVER INSTALLATION	11
2.3 HARDWARE INSTALLATION.....	12
2.4 DEVICE SETUP & CONFIGURATION.....	15
3. SIGNAL CONNECTIONS	19
3.1 OVERVIEW	19
3.2 SWITCH AND JUMPER SETTINGS	19
3.3 SIGNAL CONNECTIONS	21
3.4 FIELD WIRING CONSIDERATIONS.....	23
APPENDIX A. SPECIFICATIONS	25
APPENDIX B. BLOCK DIAGRAM	27
APPENDIX C. REGISTER STRUCTURE AND FORMAT	29
C.1 OVERVIEW	29
C.2 I/O PORT ADDRESS MAP	29
C.3 D/A CHANNELS OUTPUT DATA — BASE+00H~0EH.....	33
C.4 D/A CHANNELS LATCH DATA — BASE+00H~0EH	34
C.5 BOARD ID — BASE+10H	35
C.6 ALL D/A CHANNELS SYNCHRONIZED SETTING — BASE+12H.....	36
C.7 ALL D/A CHANNELS SYNCHRONIZED STATUS — BASE+12H	36
C.8 DAC RANGE AND CALIBRATION MODE — BASE+14H	37

C.9	DAC RANGE AND CALIBRATION STATUS — BASE+14H.....	38
C.10	SADC CONTROL COMMAND FOR CALIBRATION FUNCTION— BASE+16H.....	40
C.11	SADC CONTROL STATUS FOR CALIBRATION FUNCTION— BASE+16H.....	40
C.12	CALIBRATION PARAMETER STROBE — BASE+18H.....	41
C.13	DIGITAL I/O SETTING — BASE+1AH.....	42
C.14	DIGITAL I/O PORT MODE — BASE+1AH.....	42
C.15	WRITE DIGITAL OUTPUT COMMAND — BASE+1CH.....	43
C.16	READ DIGITAL INPUT DATA — BASE+1CH.....	43
C.17	WRITE CALIBRATION COMMAND — BASE+1EH.....	44
C.18	READ CALIBRATION STATUS — BASE+1EH.....	44
C.19	SYNCHRONIZED STROBE — BASE+20H.....	45
C.20	RESET ALL D/A CHANNELS STROBE — BASE+22H.....	45
C.21	RESET THE CALIBRATION CONTROLLER STROBE — BASE+24H.....	46
C.22	CHANGE D/A CHANNELS OUTPUT TYPE STROBE — BASE+26H.....	46
C.23	SELECT THE CALIBRATION REF_V — BASE+28H.....	47
C.24	SUMMARY.....	47
APPENDIX D. CALIBRATION		49
D.1	VR ASSIGNMENT	50
D.2	D/A CALIBRATION	51
D.3	CALIBRATION UTILITY	52

1. Introduction

Thank you for buying the Advantech PCI-1723. The PCI-1723 is a non-isolated multiple channels analog output card for PCI bus, and each of analog output channels is equipped with a 16-bit, double-buffered DAC. It features auto-calibration function and Board ID.

The PCI-1723 is an ideal solution for industrial applications where multiple analog output channels are required.

The following sections of this chapter will provide further information about features of the multifunction cards, a Quick Start for installation, together with some brief information on software and accessories for the PCI-1723 card.

1.1 Features

- Auto calibration function
- A 16-bit DAC is equipped for each of analog output channels
- Flexible output range: $\pm 10\text{V}$, 0~20 mA, 4~20 mA
- Synchronized output function
- Keeping output values after system hot reset
- 2-port (16-channel) user-defined digital input/output
- Board ID

The Advantech PCI-1723 offers the following main features:

Auto-calibration Function

The PCI-1723 provides an auto-calibration function by using a calibration utility. The built-in calibration circuitry of the PCI-1723 corrects gain and offset errors in analog output channels, thereby eliminating the need for external equipment and user adjustments.

Flexible Voltage Output Range

The PCI-1723 provides fixed voltage output range as $\pm 10V$ to fulfill your flexible range needed applications. User can define the specific voltage output range and output data format via the enclosed software utility and driver.

Keeping the Output Values After System Reset

Users can independently set the eight outputs to different ranges: $\pm 10V$, 0~20mA or 4~20mA, and all the ranges are software selectable. When the system is hot reset (power not shut down), the PCI-1723 can either retain the last analog output values, or return to its default configuration, depending on jumper setting. This practical function eliminates danger caused by miss-operation during unexpected system reset.

Board ID

The PCI-1723 has a built-in DIP Switch that helps define each card's ID when multiple PCI-1723 cards have been installed on the same PC chassis. The board ID setting function is very useful when users build their system with multiple PCI-1723 cards. With correct Board ID settings, you can easily identify and access each card during hardware configuration and software programming.

Note:

- ✎ For detailed specifications of the PCI-1723, please refer to *Appendix A, Specifications*.
-

1.2 Applications

- Process control
- Programmable voltage source
- Programmable current sink
- Servo control
- Multiple loop PID control

1.3 Installation Guide

Before you install your PCI-1723 card, please make sure you have the following necessary components:

- PCI-1723 DA&C card**
- PCI-1723 User's Manual**
- Driver software** Advantech DLL drivers
(included in the companion CD-ROM)
- Wiring cable** PCL-10168 (option)
- Wiring board** ADAM-3968 (option)
- Computer** Personal computer or workstation with a
PCI-bus slot (running Windows 2000/95/
98/NT/ME/XP)

Some other optional components are also available for enhanced operation:

- Application software** ActiveDAQ, GeniDAQ or other third-party
software packages

After you get the necessary components and maybe some of the accessories for enhanced operation of your Multifunction card, you can then begin the Installation procedures. Figure 1-1 on the next page provides a concise flow chart to give users a broad picture of the software and hardware installation procedures:

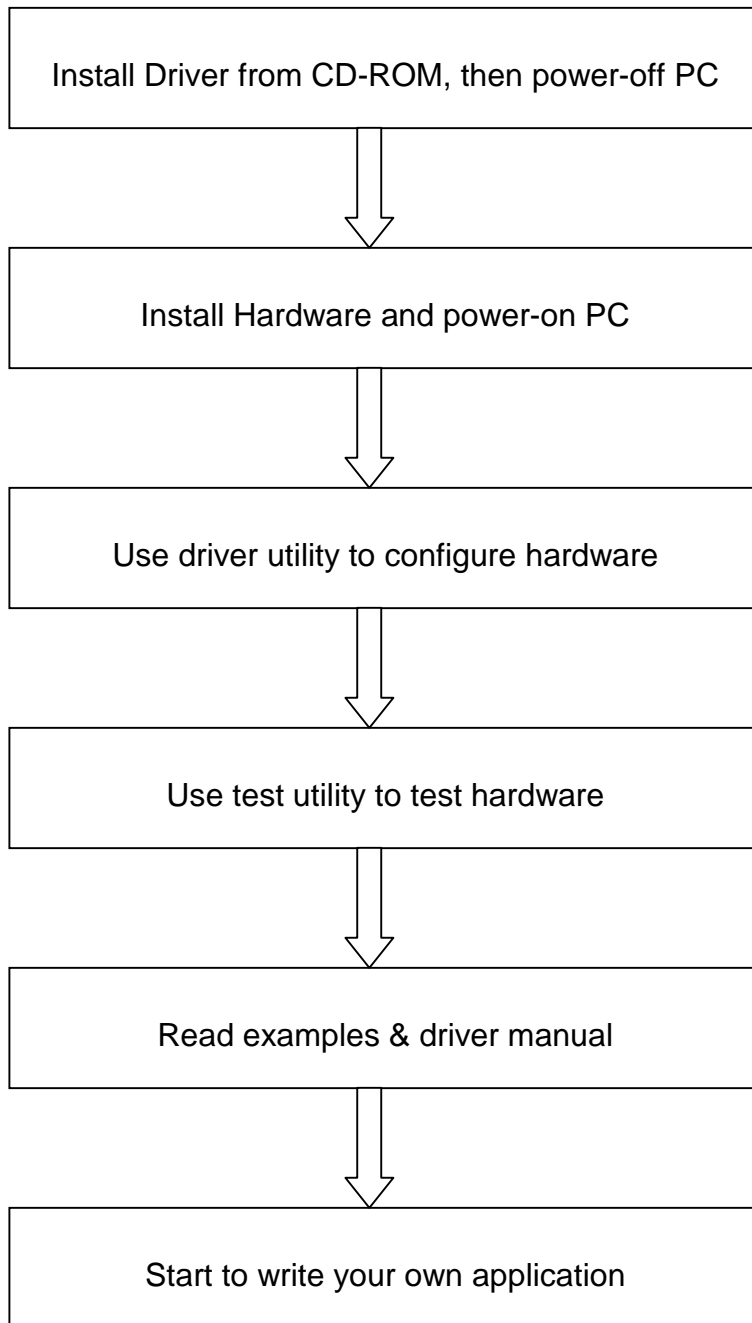


Fig. 1-1 Installation Flow Chart

1.4 Software Overview

Advantech offers a rich set of DLL drivers, third-party driver support and application software to help fully exploit the functions of your PCI-1723 card:

- ❑ Device Drivers (on the companion CD-ROM)
- ❑ LabVIEW driver
- ❑ Advantech ActiveDAQ
- ❑ Advantech GeniDAQ

Programming choices for DA&C cards: You may use Advantech application software such as Advantech Device Drivers. On the other hand, advanced users are allowed another option for register-level programming, although not recommended due to its laborious and time-consuming nature.

Device Drivers

The Advantech Device Drivers software is included on the companion CD-ROM at no extra charge. It also comes with all the Advantech DA&C cards. Advantech's Device Drivers features a complete I/O function library to help boost your application performance. The Advantech Device Drivers for Windows 2000/95/98/NT/ME/XP works seamlessly with development tools such as Visual C++, Visual Basic, Inprise C++ Builder and Inprise Delphi.

Register-level Programming

Register-level programming is reserved for experienced programmers who find it necessary to write codes directly at the level of device registers. Since register-level programming requires much effort and time, we recommend that you use the Advantech Device Drivers instead. However, if register-level programming is indispensable, you should refer to the relevant information in *Appendix C, Register Structure and Format*, or to the example codes included on the companion CD-ROM.

1.5 Device Drivers Programming Roadmap

This section will provide you a roadmap to demonstrate how to build an application from scratch using Advantech Device Drivers with your favorite development tools such as Visual C++, Visual Basic, Delphi and C++ Builder. The step-by-step instructions on how to build your own applications using each development tool will be given in the *Device Drivers Manual*. Moreover, a rich set of example source codes are also given for your reference.

Programming Tools

Programmers can develop application programs with their favorite development tools:

- **Visual C++**
- **Visual Basic**
- **Delphi**
- **C++ Builder**

For instructions on how to begin programming works in each development tool, Advantech offers a *Tutorial* Chapter in the *Device Drivers Manual* for your reference. Please refer to the corresponding sections in this chapter on the *Device Drivers Manual* to begin your programming efforts. You can also take a look at the example source codes provided for each programming tool, since they can get you very well-oriented.

The *Device Drivers Manual* can be found on the companion CD-ROM. Or if you have already installed the Device Drivers on your system, The *Device Drivers Manual* can be readily accessed through the **Start** button:

Start/Programs/Advantech Device Driver V2.0/Device Driver Manual

The example source codes could be found under the corresponding installation folder such as the default installation path:

\Program Files\Advantech\ADSAPI\Examples

For information about using other function groups or other

development tools, please refer to the *Creating Windows 95/NT/2000 Application with Device Drivers* chapter and the *Function Overview* chapter on the *Device Drivers Manual*.

Programming with Device Drivers Function Library

Advantech Device Drivers offers a rich function library to be utilized in various application programs. This function library consists of numerous APIs that support many development tools, such as Visual C++, Visual Basic, Delphi and C++ Builder.

According to their specific functions or services, those APIs can be categorized into several function groups:

- Analog Output Function Group**
- Digital Input/Output Function Group**
- Counter Function Group**
- Port Function Group (direct I/O)**
- Event Function Group**

For the usage and parameters of each function, please refer to the *Function Overview* chapter in the *Device Drivers Manual*.

Troubleshooting Device Drivers Error

Driver functions will return a status code when they are called to perform a certain task for the application. When a function returns a code that is not zero, it means the function has failed to perform its designated function. To troubleshoot the Device Drivers error, you can pass the error code to **DRV_GetErrorMessage** function to return the error message. Or you can refer to the *Device Drivers Error Codes* Appendix in the *Device Drivers Manual* for a detailed listing of the Error Code, Error ID and the Error Message.

1.6 Accessories

Advantech offers a complete set of accessory products to support the PCI-1723 card. These accessories include:

Wiring Cable

- **PCL-10168** The PCL-10168 shielded cable is specially designed for PCI-1723 cards to provide high resistance to noise. To achieve a better signal quality, the signal wires are twisted in such a way as to form a “twisted-pair cable”, reducing cross-talk and noise from other signal sources. Furthermore, its analog and digital lines are separately sheathed and shielded to neutralize EMI/EMC problems.

Wiring Boards

- **ADAM-3968** The ADAM-3968 is a 68-pin SCSI wiring terminal module for DIN-rail mounting. This terminal module can be readily connected to the Advantech PC-Lab cards and allow easy yet reliable access to individual pin connections for the PCI-1723 card.

2. Installation

This chapter gives users a package item checklist, proper instructions about unpacking and step-by-step procedures for both driver and card installation.

2.1 Unpacking

After receiving your PCI-1723 package, please inspect its contents first. The package should contain the following items:

- PCI-1723 card
- Companion CD-ROM (Device Drivers included)
- User's Manual

The PCI-1723 card harbors certain electronic components vulnerable to *electrostatic discharge* (ESD). ESD could easily damage the integrated circuits and certain components if preventive measures are not carefully paid attention to.

Before removing the card from the antistatic plastic bag, you should take following precautions to ward off possible ESD damage:

- Touch the metal part of your computer chassis with your hand to discharge static electricity accumulated on your body. Or one can also use a grounding strap.
- Touch the anti-static bag to a metal part of your computer chassis before opening the bag.
- Take hold of the card only by the metal bracket when removing it out of the bag.

After taking out the card, first you should:

- Inspect the card for any possible signs of external damage (loose or damaged components, etc.). If the card is visibly damaged, please notify our service department or our local sales representative immediately. Avoid installing a damaged card into your system.

Also pay extra caution to the following aspects to ensure proper installation:

- ✦ Avoid physical contact with materials that could hold static electricity such as plastic, vinyl and Styrofoam.
- ✦ Whenever you handle the card, grasp it only by its edges. DO NOT TOUCH the exposed metal pins of the connector or the electronic components.

Note:

- ✦ Keep the anti-static bag for future use. You might need the original bag to store the card if you have to remove the card from PC or transport it elsewhere.
-

2.2 Driver Installation

We recommend you to install the driver before you install the PCI-1723 card into your system, since this will guarantee a smooth installation process.

The Advantech Device Drivers Setup program for the PCI-1723 card is included on the companion CD-ROM that is shipped with your DA&C card package. Please follow the steps below to install the driver software:

Step 1: Insert the companion CD-ROM into your CD-ROM drive.

Step 2: The Setup program will be launched automatically if you have the autoplay function enabled on your system. When the Setup Program is launched, you'll see the following Setup Screen.

Note:

- ✎ If the autoplay function is not enabled on your computer, use Windows Explorer or Windows **Run** command to execute SETUP.EXE on the companion CD-ROM.
-



Fig. 2-1 The Setup Screen of Advantech Automation Software

Step 3: Select the *Device Drivers* option.

Step 4: Select the specific device then just follow the installation instructions step by step to complete your device driver installation and setup.



Fig. 2-2 Different options for Driver Setup

For further information on driver-related issues, an online version of *Device Drivers Manual* is available by accessing the following path:

Start/Programs/Advantech Device Drivers V2.0/Device Drivers Manual

2.3 Hardware Installation

Note:

- ⚡ Make sure you have installed the driver first before you install the card (please refer to 2.2 *Driver Installation*)
-

After the Device Drivers installation is completed, you can now go on to install the PCI-1723 card in any PCI slot on your computer. But it is suggested that you should refer to the computer user manual or related documentation if you have any doubt. Please follow the steps below to install the card on your system.

- Step 1:** Turn off your computer and unplug the power cord and cables.
TURN OFF your computer before installing or removing any components on the computer.
- Step 2:** Remove the cover of your computer.
- Step 3:** Remove the slot cover on the back panel of your computer.
- Step 4:** Touch the metal part on the surface of your computer to neutralize the static electricity that might be on your body.
- Step 5:** Insert the PCI-1723 card into a PCI slot. Hold the card only by its edges and carefully align it with the slot. Insert the card firmly into place. Use of excessive force must be avoided, otherwise the card might be damaged.
- Step 6:** Fasten the bracket of the PCI card on the back panel rail of the computer with screws.
- Step 7:** Connect appropriate accessories (68-pin cable, wiring terminals, etc. if necessary) to the PCI card.
- Step 8:** Replace the cover of your computer chassis. Re-connect the cables you removed in step 2.
- Step 9:** Plug in the power cord and turn on the computer.

Note:

- ⚡ In case you installed the card without installing the Device Drivers first, Windows 95/98/ME will recognize your card as an “unknown device” after rebooting, and will prompt you to provide the necessary driver. You should ignore the prompting messages (just click the *Cancel* button) and set up the driver according to the steps described in 2.2 *Driver Installation*.
-

After the PCI-1723 card is installed, you can verify whether it is properly installed on your system in the *Device Manager*:

1. Access the *Device Manager* through *Control Panel/System/Device Manager*.
2. The *device name* of the PCI-1723 should be listed on the *Device Manager* tab on the *System Property Page*.

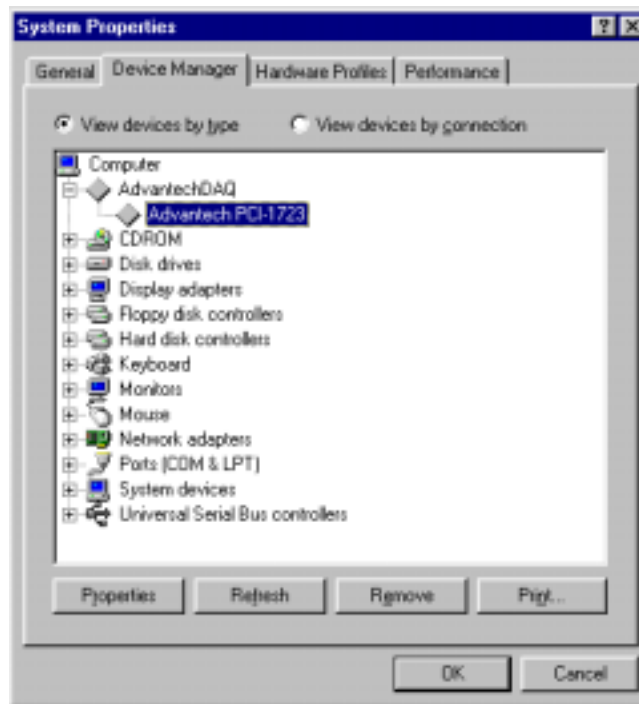


Fig. 2-3 The device name listed on the Device Manager

Note:

- ✎ If your card is properly installed, you should see the *device name* of your card listed on the *Device Manager* tab. **If you do see your device name listed on it but marked with an exclamation sign “!”, it means your card has not been correctly installed.** In this case, remove the card device from the *Device Manager* by selecting its device name and press the **Remove** button. Then go through the driver installation process again.
-

After your card is properly installed on your system, you can now configure your device using the *Advantech Device Manager* Program that has itself already been installed on your system during driver setup. A complete device installation procedure should include *device setup*, *configuration* and *testing*. The following sections will guide you through the Setup, Configuration and Testing of your device.

2.4 Device Setup & Configuration

The *Advantech Device Manager* program is a utility that allows you to set up, configure and test your device, and later stores your settings on the system registry. These settings will be used when you call the APIs of Advantech Device Drivers.

Setting Up the Device

Step 1: To install the I/O device for your card, you must first run the *Device Installation* program (by accessing *Start/Programs/Advantech Device Driver V2.0*).

Step 2: You can then view the device(s) already installed on your system (if any) on the *Installed Devices* list box. Since you haven't installed any device yet, you might see a blank list such as the one below (Fig. 2-4).



Fig. 2-4 The Device Manager dialog box

Step 3: Scroll down the *List of Devices* box to find the device that you wish to install, then click the *Add...* button to evoke the *Device(s) found* dialog box such as one shown in Fig. 2-5. The *Device(s) found* dialog box lists all the installed devices on your system. Select the device you want to configure from the list box and press the **OK** button. After you have clicked **OK**, you will see a *Device Setting* dialog box such as the one in Fig. 2-6.

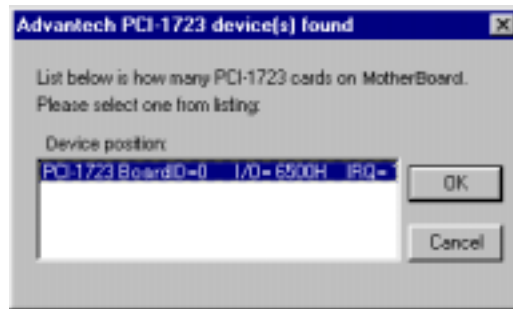


Fig. 2-5 The “Device(s) Found” dialog box

Configuring the Device

Step 4: On the *Device Setting* dialog box (Fig. 2-6), you can configure the voltage source either as *External* or *Internal*, and specify the voltage output range for the 8 D/A channels.

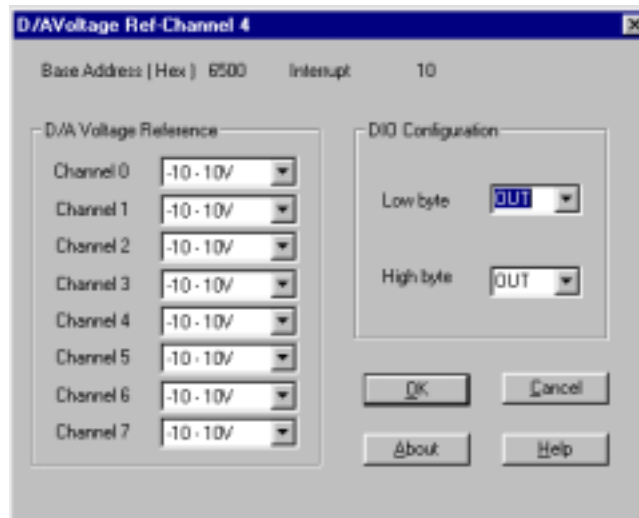


Fig. 2-6 The Device Setting dialog box

Note:

- Users can configure the source of D/A reference voltage either as *Internal* or *External*, and select the output voltage range. When selecting voltage source as *Internal*, users have three options for the output voltage ranges and current ranges: **-10 ~ 10 V**, **0~20 mA** and **4~20 mA**.

When selected as *External*, the output voltage range is determined by the external reference voltage in the following way:

By inputting an external reference voltage: $-xV$, where $|x| \leq 10$, you will get a output voltage range: 0 to xV .

Step 5: After you have finished configuring the device, click **OK** and the *device name* will appear in the *Installed Devices* box as seen below:



Fig. 2-7 The Device Name appearing on the list of devices box

Note:

- As we have noted, the *device name* “**000:PCI-1723 BoardID=0 I/O=6500H**” begins with a *device number* “000”, which is specifically assigned to each card. The *device number* is passed to the driver to specify which device you wish to control.
-

After your card is properly installed and configured, you can click the ***Test...*** button to test your hardware by using the testing utility we supplied. For more detailed information, please refer to *Chapter 2* of the *Device Drivers Manual*.

You can also find the rich examples on the CD-ROM to speeding up your programming.

3. Signal Connections

3.1 Overview

Maintaining signal connections is one of the most important factors in ensuring that your application system is sending and receiving data correctly. A good signal connection can avoid unnecessary and costly damage to your PC and other hardware devices. This chapter provides useful information about how to connect input and output signals to the PCI-1723 via the I/O connector.

3.2 Switch and Jumper Settings

The PCI-1723 card has one function switch and five jumper settings.

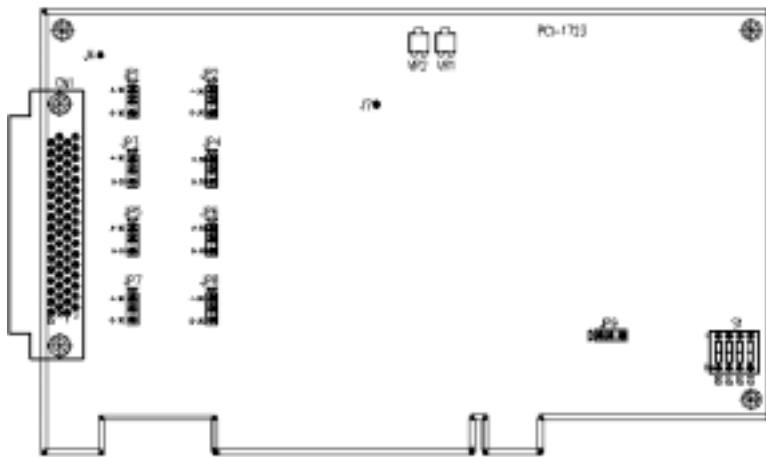






Fig. 3-1 Card connector, jumper and switch locations

Table 3-1: Summary of jumper settings

Names of Jumpers	Function description			
JP9		Keep last status after hot reset.		
		Default configuration.		
JP1~JP8		4~20 mA		0~20 mA

Setting the time to reset the analog outputs

Some users will want the capability of clearing each analog output when the system (or PC) issues a reset signal on the PCI bus. Some users will want to clear their analog output only as part of system power-on. The PCI-1723 satisfies both these needs by providing jumper JP1. Depending on the application, this capability may allow analog outputs to be "ZERO" without requiring a complete shutdown of processes controlled by the card.

Complete loss of power to the chip clears the chip memory. Thus, no matter how JP1 is set, if the power to the PCI-1723 is disconnected, the analog output initial power-on state will be "ZERO".

Board ID setting

ID3	ID2	ID1	ID0	Board ID
1	1	1	1	0
1	1	1	0	1
1	1	0	1	2
1	1	0	0	3
1	0	1	1	4
1	0	1	0	5
1	0	0	1	6
1	0	0	0	7
0	1	1	1	8
0	1	1	0	9
0	1	0	1	10
0	1	0	0	11
0	0	1	1	12
0	0	1	0	13
0	0	0	1	14
0	0	0	0	15

Note: On: 1, Off: 0

3.3 Signal Connections

Pin Assignment

Figure 3-2 shows the pin assignments for the 68-pin I/O connector on the PCI-1723.

NC	68	34	NC
Vout0	67	33	Vout1
AGND	66	32	AGND
Iout0	65	31	Iout1
NC	64	30	NC
AGND	63	29	AGND
Vout2	62	28	Vout3
AGND	61	27	AGND
Iout2	60	26	Iout3
NC	59	25	NC
AGND	58	24	AGND
Vout4	57	23	Vout5
AGND	56	22	AGND
Iout4	55	21	Iout5
NC	54	20	NC
AGND	53	19	AGND
Vout6	52	18	Vout7
AGND	51	17	AGND
Iout6	50	16	Iout7
NC	49	15	NC
AGND	48	14	AGND
DIO0	47	13	DIO1
DIO2	46	12	DIO3
DIO4	45	11	DIO5
DIO6	44	10	DIO7
DIO8	43	9	DIO9
DIO10	42	8	DIO11
DIO12	41	7	DIO13
DIO14	40	6	DIO15
DGND	39	5	DGND
NC	38	4	NC
NC	37	3	NC
NC	36	2	NC
+12V	35	1	+5V

Fig. 3-2 I/O connector pin assignments for the PCI-1723

I/O Connector Signal Description

Table 3-2 I/O Connector Signal Description

Signal Name	Reference	Direction	Description
Vout<0..3>	AGND	Output	Voltage Output, Channels 0 through 3.
Iout<0..3>	AGND	Output	Current Output, Channels 0 through 3.
AGND	-	-	Analog Ground. The two ground references (AGND and DGND) are connected together on the PCI-1723 card.
DI0<0..15>	DGND	-	Digital Input / Output signals. These pins are digital input / Output channel 0 to 15.
DGND	-	-	Digital Ground. The two ground references (AGND and DGND) are connected together on the PCI-1723 card.
+12V	DGND	Output	+12 V_{DC} Source (from PCI bus directly with FUSE protection).
+5V	DGND	Output	+5 V_{DC} Source (from PCI bus directly with FUSE protection).

Analog output connection

The PCI-1723 provides eight D/A output channels, **Vout_0 ~ Vout_7** and **Iout_0 ~ Iout_7**. Users may use the PCI-1723 internally-provided precision -5V (-10V) reference to generate 0 to +5 V (+10 V) D/A output range. Users also may create D/A output range through external references, **REF_V0 ~ REF_V3**. The external reference input range is +/-10 V. For example, connecting with an external reference of -7 V will generate 0 ~ +7 V D/A output.

Figure 3-3 shows how to make analog output and external reference input connections on the PCI-1723.

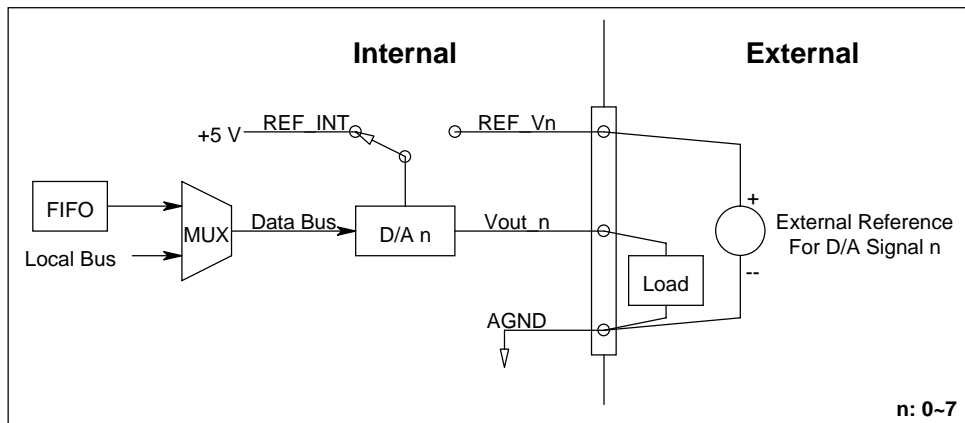


Figure 3-3: Analog output connections

3.4 Field Wiring Considerations

When you use the PCI-1723 to acquire data from outside, noises in the environment might significantly affect the accuracy of your measurements if due cautions are not taken. The following measures will be helpful to reduce possible interference running signal wires between signal sources and the PCI-1723.

- The signal cables must be kept away from strong electromagnetic sources such as power lines, large electric motors, circuit breakers or welding machines, since they may cause strong electromagnetic interference. Keep the analog signal cables away from any video monitor, since it can significantly affect a data acquisition system.
- If the cable travels through an area with significant electromagnetic interference, you should adopt individually shielded, twisted-pair wires as the analog input cable. This type of cable has its signal wires twisted together and shielded with a metal mesh. The metal mesh should only be connected to one point at the signal source ground.
- Avoid running the signal cables through any conduit that might have power lines in it.
- If you have to place your signal cable parallel to a power line that has a high voltage or high current running through it, try to keep a safe distance between them. Or, you should place the signal cable at a right angle to the power line to minimize the undesirable effect.
- The signals transmitted on the cable will be directly affected by the quality of the cable. In order to ensure better signal quality, we recommend that you use the PCL-10168 shielded cable.

Appendix A. Specifications

Analog Output

Channels	8	
Resolution	16-bit	
Operation mode	Single output, Synchronized output	
Output Range (Internal Reference only)	-10~+10V, 0~20 mA, 4~20 mA	
Accuracy	Relative	± 6 LSB
	Differential Non-linearity	± 6 LSB (monotonic)
Offset	< 6 LSB	
Output Impedance	Ω 1max.	
Throughput	PC dependent, Software update (direct AO)	
Settling time	50 us (to ± 6 LSB of FSR)	

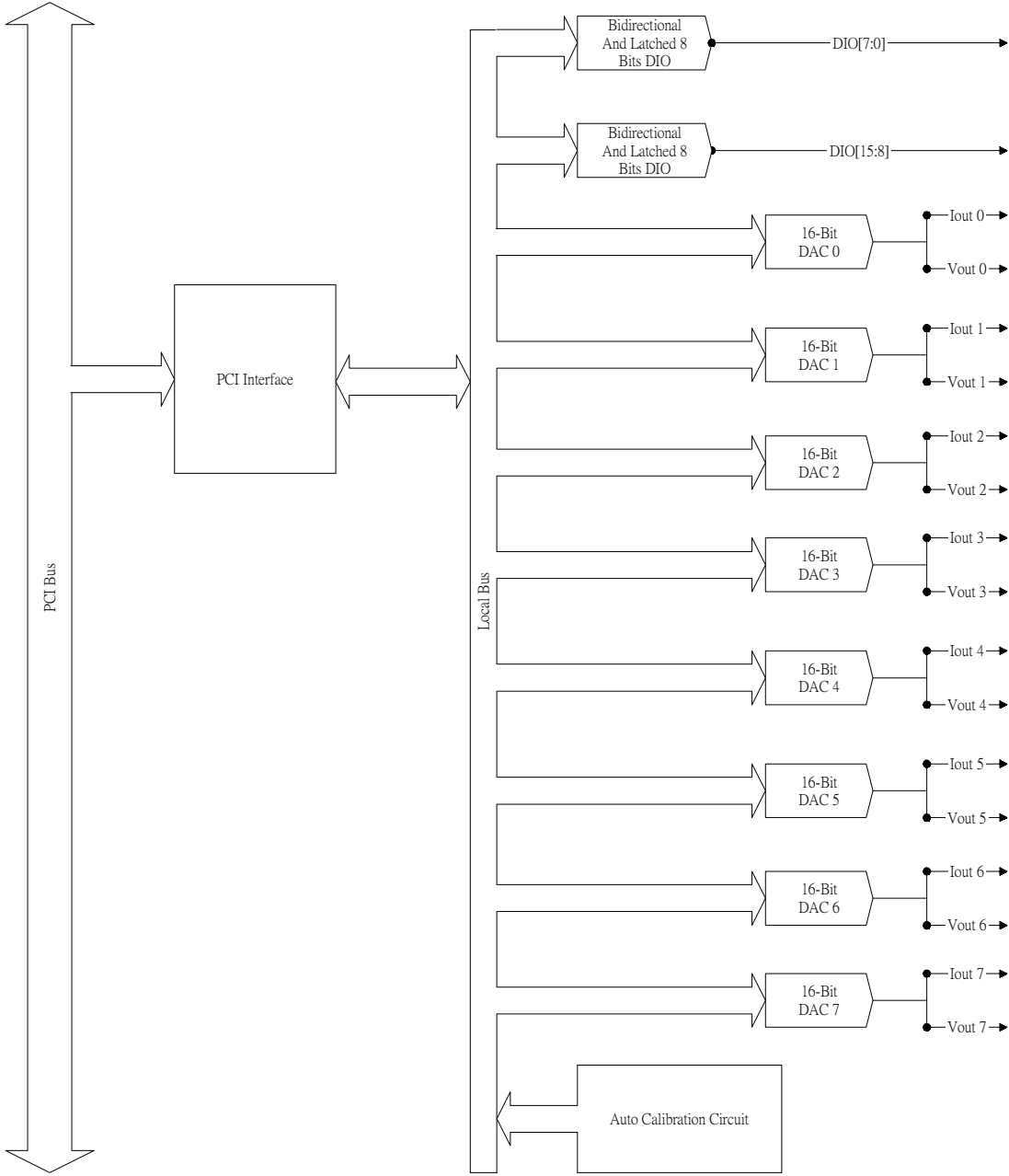
Digital Input /Output

Input Channels	16 (bi-directional)	
Number of ports	2	
Input Voltage	Low	0.8 V max.
	High	2.0 V min.
Output Voltage	Low	0.5 V max. @ +24 mA (sink)
	High	2.0 V min. @ -15 mA (source)

General

I/O Connector Type	68-pin SCSI-II female	
Dimensions	175 mm x 100 mm (6.9" x 3.9")	
Power Consumption	Typical	+5 V @ 850 mA, +12 V @ 600 mA
	Max.	+5 V @ 1 A, +12 V @ 700 mA
Temperature	Operation	0~60 ° C(32~158° F) (refer to IEC 68-2-1,2)
	Storage	-20~85° C (-4~185° F)
Relative Humidity	5~95%RH non-condensing (refer to IEC 68-2-3)	
Certification	CE certified	

Appendix B. Block Diagram



Appendix C. Register Structure and Format

C.1 Overview

The PCI-1723 is delivered with an easy-to-use 32-bit Device Drivers for user programming under the Windows 2000/95/98/NT/ME/XP operating system. We advise users to program the PCI-1723 using the 32-bit Device Drivers provided by Advantech to avoid the complexity of low-level programming by register.

The most important consideration in programming the PCI-1723 the register level is to understand the function of the card's registers. The information in the following sections is provided only for users who would like to do their own low-level programming.

C.2 I/O Port Address Map

The PCI-1723 requires 32 consecutive addresses in the PC's I/O space. The address of each register is specified as an offset from the card's base address. For example, BASE+0 is the card's base address and BASE+7 is the base address plus seven bytes.

The table C-1 shows the function of each register of the PCI-1723 or driver and its address relative to the card's base address.

Table C-1 PCI-1723 register format (Part 1)

Base Address + HEX		PCI-1723 Register Format															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
00H	W	D/A channel 0 output data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
00H	R	D/A channel 0 latch data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
02H	W	D/A channel 1 output data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
02H	R	D/A channel 1 latch data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
04H	W	D/A channel 2 output data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
04H	R	D/A channel 2 latch data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
06H	W	D/A channel 3 output data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
06H	R	D/A channel 3 latch data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
08H	W	D/A channel 4 output data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
08H	R	D/A channel 4 latch data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
0AH	W	D/A channel 5 output data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
0AH	R	D/A channel 5 latch data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
0CH	W	D/A channel 6 output data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
0CH	R	D/A channel 6 latch data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
0EH	W	D/A channel 7 output data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
0EH	R	D/A channel 7 latch data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0

Table C-1 PCI-1723 register format (Part 2)

Base Address + HEX		PCI-1723 Register Format															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
10H	W	N/A															
	R	Board ID															
		0	0	0	0	0	0	0	0	0	0	0	0	BD3	BD2	BD1	BD0
12H	W	All D/A channels synchronized setting															
	R	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	SYNC
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	SYNC
14H	W	DAC range and calibration mode															
	R	X	X	X	X	X	X	SELF	X	X	R1	R0	O_G	CH2	CH1	CH0	
		BUSY	INIT	X	X	X	X	SELF	IDX1	IDX0	R1	R0	O_G	CH2	CH1	CH0	
16H	W	SADC control command for calibration function															
	R	X	X	X	X	X	X	X	X	X	X	X	X	X	CS	DAT	CLK
		X	X	X	X	X	X	X	X	X	X	X	X	CS	DAT	CLK	
18H	W	Calibration parameter strobe															
	R	N/A															
1AH	W	Digital I/O port setting															
	R	X	X	X	X	X	X	X	X	X	X	X	X	X	HDIO	LDIO	
		0	0	0	0	0	0	0	0	0	0	0	0	0	HDIO	LDIO	
1CH	W	Write digital output command															
	R	Read digital input data															
		D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
1EH	W	Write calibration command															
	R	Read calibration status															
		0	0	0	0	0	0	0	0	D7	D6	D5	D4	D3	D2	D1	D0

Table C-1 PCI-1723 register format (Part 3)

Base Address + HEX		PCI-1723 Register Format															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
20H	W	Synchronized strobe															
		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
20H	R	N/A															
22H	W	Reset all D/A channels strobe															
		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
22H	R	N/A															
24H	W	Reset the calibration controller strobe															
		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
24H	R	N/A															
26H	W	Change D/A channels output type strobe															
		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
26H	R	N/A															
28H	W	Select the calibration Ref_V														REF_	REF_
		X	X	X	X	X	X	X	X	X	X	X	X	X	X	A1	A0
28H	R	N/A															

C.3 D/A channels output data — BASE+00H~0EH

Table C-2 Register for D/A channels output data

Base Addr.		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
00H	W	D/A channel 0 output data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
02H	W	D/A channel 1 output data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
04H	W	D/A channel 2 output data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
06H	W	D/A channel 3 output data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
08H	W	D/A channel 4 output data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
0AH	W	D/A Channel 5 output data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
0CH	W	D/A channel 6 output data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
0EH	W	D/A channel 7 output data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0

DA15 ~ DA0 **D/A channel output data**

DA0 the least significant bit (LSB) of the D/A data

DA15 the most significant bit (MSB)

C.4 D/A channels latch data — BASE+00H~0EH

Table C-3 Register for D/A channels latch data

Base Addr.		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
00H	R	D/A channel 0 latch data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
02H	R	D/A channel 1 latch data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
04H	R	D/A channel 2 latch data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
06H	R	D/A channel 3 latch data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
08H	R	D/A channel 4 latch data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
0AH	R	D/A channel 5 latch data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
0CH	R	D/A channel 6 latch data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
0EH	R	D/A channel 7 latch data															
		DA15	DA14	DA13	DA12	DA11	DA10	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0

DA15 ~ DA0 **D/A channel latch data**

DA0 the least significant bit (LSB) of the D/A data

DA15 the most significant bit (MSB)

C.5 Board ID — BASE+10H

The PCI-1723 offers Board ID register BASE+10H. With correct Board ID settings, user can easily identify and access each card during hardware configuration and software programming.

Table C-4 Register for Board ID

Base Addr.		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
10H	R	Board ID															
		0	0	0	0	0	0	0	0	0	0	0	0	0	BD3	BD2	BD1

BD3 ~ DB0

Board ID

BD0 LSB of the Board ID

BD3 MSB of the Board ID

BD3	BD2	BD1	BD0	Board ID
1	1	1	1	15
1	1	1	0	14
1	1	0	1	13
1	1	0	0	12
1	0	1	1	11
1	0	1	0	10
1	0	0	1	9
1	0	0	0	8
0	1	1	1	7
0	1	1	0	6
0	1	0	1	5
0	1	0	0	4
0	0	1	1	3
0	0	1	0	2
0	0	0	1	1
0	0	0	0	0

C.6 All D/A channels synchronized setting — BASE+12H

The PCI-1723 provides the innovate function which all D/A channels can output the data synchronization.

Table C-5 Register for all D/A channels synchronized setting

Base Addr.		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
12H	W	All D/A channels synchronized setting															
		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

SYNC

D/A channels output synchronous

0 Disable (all D/A channels output directly)

1 Enable

Note:

- ✎ Be sure to enable the synchronize function by write the value to this register first. Next, write the specific data into **BASE+00H ~ 0FH**. Last, to write any value to **BASE+12H** to synchronize all D/A channels.
 - ✎ On the other hand, if you didn't enable the synchronize function by write the value to this register first, all the specific data which write to **BASE+00H ~ 0FH** will be output immediately!
-

C.7 All D/A channels synchronized status — BASE+12H

Table C-6 Register for all D/A channels synchronized status

Base Addr.		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
12H	R	All D/A channels synchronized status															
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

SYNC

D/A channels output synchronous

0 Disable (all D/A channels output directly)

1 Enable

C.8 DAC range and calibration mode — BASE+14H

Table C-7 Register for DAC range and calibration mode

Base Addr.		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
14H	W	DAC range and calibration mode															
		X	X	X	X	X	X	X	SELF	X	X	R1	R0	O_G	CH2	CH1	CH0

CH2 ~ CH0 Select D/A channel

000	Channel 0
001	Channel 1
010	Channel 2
011	Channel 3
100	Channel 4
101	Channel 5
110	Channel 6
111	Channel 7

O_G Calibrate gain or offset

0	Gain
1	Offset

R1 ~ R0 Select D/A range

00	± 10V
01	N/A
10	0 ~ 20 mA
11	4 ~ 20 mA

SELF Select normal or self-system calibration

0	Normal calibration
1	Self-system offset calibration

Note:

- Once you want to change the range of the specific channel, be sure to write the value to this register first. After that, to write any value to **BASE+26H** to strobe the change.
-

C.9 DAC range and calibration status — BASE+14H

Table C-8 Register for DAC range and calibration status

Base Addr.		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
14H	R	DAC range and calibration status															
		BUSY	INIT	X	X	X	X	X	SELF	IDX1	IDX0	R1	R0	O_G	CH2	CH1	CH0

CH2 ~ CH0 Select D/A channel

000	Channel 0
001	Channel 1
010	Channel 2
011	Channel 3
100	Channel 4
101	Channel 5
110	Channel 6
111	Channel 7

O_G Calibrate gain or offset

0	Gain
1	Offset

R1 ~ R0 Select D/A range

00	± 10V
01	N/A
10	0 ~ 20 mA
11	4 ~ 20 mA

SELF Select normal or self-system calibration

0	Normal calibration
1	Self-system offset calibration

INIT Initial the calibration controller

0	Idle
1	Processing

BUSY Calibration controller busy flag

0	Idle
1	Busy

IDX1 ~ IDX0 Calibration procedure index

- 00** Read/Write calibration status
- 01** Write calibration parameter
- 10** Change D/A channels output type and reload
the parameters
- 11** N/A

C.10 SADC control command for calibration function— BASE+16H

The PCI-1723 use SADC (serial analog to digital converter) for calibration function. Please refer to the Burr-Brown ADS7822 data sheet for the chipset detail information (CD-ROM:\Documents\Component Specification\ADS7822.PDF).

Table C-9 Register for SADC control command for calibration function

Base Addr.		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
16H	W	SADC control command for calibration function															
		X	X	X	X	X	X	X	X	X	X	X	X	X	X	CS	DAT

CS **SADC chip select (active low)**
DAT **SADC serial data**
CLK **SADC clock**

C.11 SADC control status for calibration function— BASE+16H

Table C-10 Register for SADC control for calibration function

Base Addr.		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
16H	R	SADC control status for calibration function															
		X	X	X	X	X	X	X	X	X	X	X	X	X	X	CS	DAT

CS **SADC chip select (active low)**
DAT **SADC serial data**
CLK **SADC clock**

C.12 Calibration parameter strobe — BASE+18H

Write any values to **BASE+18H** after finished the calibration procedure, to save all the D/A channels' parameter into the EEPROM.

Table C-11 Register for calibration parameter strobe

Base Addr.		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
18H	W	Calibration parameter strobe															
		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Note:

- Once you want to calibrate the range of the specific channel, be sure to write the value to **BASE+14H** first. Next, write the data to **BASE+1EH** for calibration purpose. Last, to write the value to this register to strobe the parameter into EEPROM.
-

C.13 Digital I/O setting — BASE+1AH

Table C-12 Register for digital I/O port setting

Base Addr.		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1AH	W	Digital I/O port setting															
		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	HDIO

LDIO Setting the Low byte DIO port

0 Output

1 Input

HDIO Setting the High byte DIO port

0 Output

1 Input

Note:

- ⊘ The port that setup as output was supported 'read back' function.
 - ⊘ The port that setup as input was supported 'mask' function.
 - ⊘ Above registries must access by word at a time.
-

C.14 Digital I/O port mode — BASE+1AH

Table C-13 Register for digital I/O port mode

Base Addr.		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1AH	R	Digital I/O port mode															
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LDIO Status of the Low byte DIO port

0 Output

1 Input

HDIO Status of the High byte DIO port

0 Output

1 Input

C.15 Write digital output command — BASE+1CH

Table C-14 Register for write digital output command

Base Addr.		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1CH	W	Write digital output command															
		D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0

D15 ~ D0

Digital output data

D0 LSB of the output data

D15 MSB of the output data

C.16 Read digital input data — BASE+1CH

Table C-15 Register for read digital input data

Base Addr.		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1CH	R	Read digital input data															
		D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0

D15 ~ D0

Digital input data

D0 LSB of the input data

D15 MSB of the input data

C.17 Write calibration command — BASE+1EH

Table C-16 Register for write calibration command

Base Addr.		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1EH	W	Write calibration command															
		X	X	X	X	X	X	X	X	X	D7	D6	D5	D4	D3	D2	D1

D7 ~ D0 Calibration result data

D0 the least significant bit (LSB) of the data

D7 the most significant bit (MSB)

Note:

- ✎ Once you want to calibrate the range of the specific channel, be sure to write the value to **BASE+14H** first. Next, write the data to this register for calibration purpose. Last, to write the value to **BASE+18H** to strobe the parameter into EEPROM.
-

C.18 Read calibration status — BASE+1EH

Table C-17 Register for read calibration status

Base Addr.		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1EH	R	Read calibration status															
		0	0	0	0	0	0	0	0	0	0	D7	D6	D5	D4	D3	D2

D7 ~ D0 Calibration result data

D0 the least significant bit (LSB) of the data

D7 the most significant bit (MSB)

C.19 Synchronized strobe — BASE+20H

Write any values to **BASE+20H** to synchronize all D/A channels.

Table C-18 Register for synchronized strobe

Base Addr.		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
20H	W	Synchronized strobe															
		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Note:

- ⚡ Be sure to enable the synchronize function by write the value to **BASE+12H** first. Next, write the specific data into **BASE+00H ~ 0FH**. Last, to write any value to this register to synchronize all D/A channels.
 - ⚡ On the other hand, if you didn't enable the synchronize function by write the value to **BASE+12H** first, all the specific data which write to **BASE+00H ~ 0FH** will be output immediately!
-

C.20 Reset all D/A channels strobe — BASE+22H

Write any values to **BASE+22H** to reset all D/A channels.

Table C-19 Register for reset all D/A channels strobe

Base Addr.		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
22H	W	Reset all D/A channels strobe															
		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

C.21 Reset the calibration controller strobe — BASE+24H

Write any values to **BASE+24H** to reset the calibration controller.

Table C-20 Register for reset the calibration controller strobe

Base Addr.		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
24H	W	Reset the calibration controller strobe															
		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

C.22 Change D/A channels output type strobe — BASE+26H

Write any values to **BASE+26H** to change D/A channels output type.

Table C-21 Register for change D/A channels output type strobe

Base Addr.		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
26H	W	Change D/A channels output type strobe															
		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Note:

- Once you want to change the range of the specific channel, be sure to write the value to **BASE+14H** first. After that, to write any value to this register to strobe the change.
-

C.23 Select the calibration Ref_V — BASE+28H

Table C-22 Register for select the calibration Ref_V

Base Addr.		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
28H	W	Select the calibration Ref_V															
		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	REF_ A1

REF_A1 ~ REF_A0	Ref_V (reference voltage) index
00	-10 V
01	0 V
10	N/A
11	+10 V

C.24 Summary

Calibrate the range of the specific channel

Step 1: BASE+14H

Step 2: BASE+1EH

Step 3: BASE+18H

Change the range of the specific channel

Step 1: BASE+14H

Step 2: BASE+26H

Synchronized output channel

Step 1: BASE+12H

Step 2: BASE+00H ~ 0FH

Step 3: BASE+20H

Appendix D. Calibration

This chapter provides brief information on PCI-1723 calibration. Regular calibration checks are important to maintain accuracy in *data acquisition and control* applications. We provide the calibration programs or utility on the companion CD-ROM to assist you in D/A calibration.

Note:

- ⌘ If you installed the program to another directory, you can find these programs in the corresponding subfolders in your destination directory.

The PCI-1723 has been calibrated at the factory for initial use. However, a calibration of the analog input and the analog output function every six months is recommended.

These calibration programs make calibration an easy job. With a variety of prompts and graphic displays, these programs will lead you through the calibration and setup procedures, showing you all the correct settings and adjustments.

To perform a satisfactory calibration, you will need a 4½-digit digital multi-meter and a voltage calibrator or a stable, noise-free D. C. voltage source.

Note:

- ⌘ Before you calibrate the D/A function, you must turn on the power at least 15 minutes to make sure the DA&C card getting stable.

A calibration utility, AutoCali, is included on the companion CD-ROM :

Cal1723.EXE PCI-1723 calibration utility

This calibration utility is designed for the Microsoft® Windows™ environment. Access this program from the default location:

C:\Program Files\Advantech\ADSAPI\Utilities\PCI1723\Windows

D.1 VR Assignment

There is two variable resistors (VR1 and VR2) on the PCI-1723 to adjust the accurate reference voltage. We have provided two test points (See J4 and J7 in Figure D-1) for you to check the reference voltage on board. Before you start to calibrate the D/A channels, please adjust VR1 until the reference voltage on J4 has between $+9.9995 \sim +10.0005$ V. And adjust VR2 until the reference voltage on J7 has between $-9.9995 \sim -10.0005$ V. Figure D-1 shows the locations of VR1, VR2, J4 and J7.

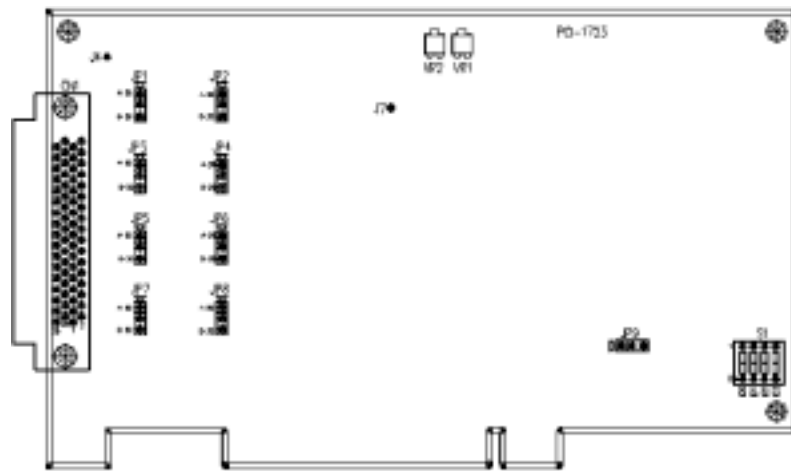


Figure D-1: PCI-1723 VR assignment

D.2 D/A Calibration

Note:

- ✎ Using a precision voltmeter to calibrate the D/A outputs is recommended.
-

The auto-calibration program AutoCali.EXE helps you finish the D/A calibration procedure automatically. Although the procedure is not necessary, the following calibration steps are provided below for your reference in case you want to implement the calibration yourself:

1. To adjust those eight jumpers JP1~JP8 to 0~20 mA.
2. Setting the output range as ± 10 V for channel 0 (BASE+14H).
3. Adjust **offset** calibration. First, output 0x8000 to channel 0. Then writing the *value* from 0x00 to 0xFF sequentially to BASE+1EH, and to see whether the output voltage is corrected. If so, to go to next step. Otherwise, you must change the *value* and repeat all the procedure in this step again until the output voltage is corrected.
4. Adjust **gain** calibration. First, output 0xFFFF to channel 0. Then writing the *value* from 0x00 to 0xFF sequentially to BASE+1EH, and to see whether the output voltage is corrected. If so, to go to next step. Otherwise, you must change the *value* and repeat all the procedure in this step again until the output voltage is corrected.
5. To change to another channel and repeat steps 2 to 4 to calibrate all eight channels.

Table D-1 D/A binary code table

A/D code		Mapping voltage/current		
Hex.	Dec.	± 10 V	0~20 mA	4~20 mA
0000h	0	-FS ± 6 LSB	N/A	N/A
8000h	32768	0 V ± 6 LSB	0 mA	4 mA
FFFFh	65535	+FS ± 6 LSB	20 mA	20 mA

Note: 1 LSB = \pm FS / 65535 = 20 / 65535

D.3 Calibration Utility

The calibration utility, AutoCali, provides two functions - auto D/A calibration and manual D/A calibration. The program helps the user to easily finish the calibration procedures automatically, however, the user can calibrate the PCI-1723 manually. The following steps will guide you through the PCI-1723 software calibration.

Step 1: Access the calibration utility program *Cal1723.exe* from the default location:

C:\Program Files\Advantech\ADSAPI\Utilities\PCI1723\Windows\Cal1723.EXE

Note:

- ✎ If you installed the program to another directory, you can find this program in the corresponding subfolders in your destination directory.
-

Step 2: Select PCI-1723 in the ADSDAQ dialog box.



Figure D-2: Selecting the device you want to calibrate

Step 3: After you start to calibrate the PCI-1723, please don't forget to adjust the VR1 and VR2.

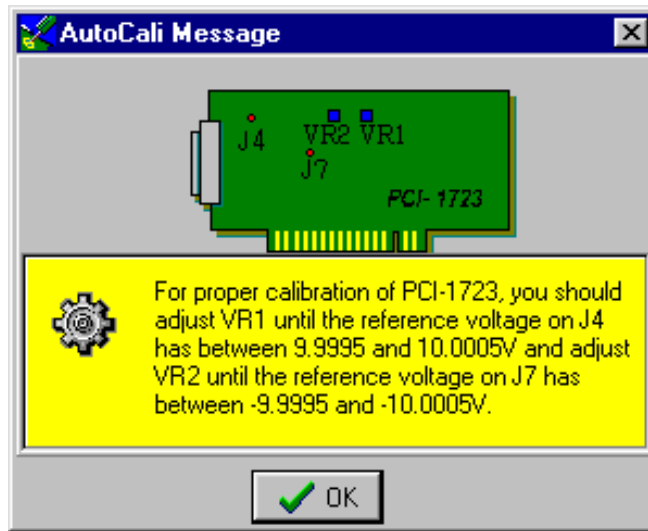


Figure D-3: Warning message before start calibration

D/A channel Auto-Calibration

Step 4: There are eight D/A channels in PCI-1723, select the output range for each channel and then press the start button to calibrate D/A channels (Fig. D-4).



Figure D-4: Range Selection in D/A Calibration

Step 5: Clicking the *Start* button, the utility will test some registers to make sure the PCI-1723 has stable enough to process the calibrate procedure (Fig. D-5)

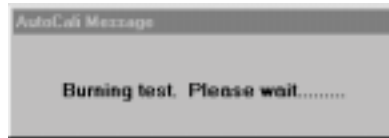


Figure D-5: Burning test

Step 6: D/A channel 0 calibration is enabled (Fig. D-6)



Figure D-6: Calibrating D/A Channel 0

Step 7: D/A channel 1 calibration is enabled (Fig. D-7)



Figure D-7: Calibrating D/A Channel 1

Step 8: Auto-calibration is finished (Fig. D-8)



Figure D-8: D/A Calibration is finished

D/A channel Manual-Calibration

Step 1: Click the *Manual D/A Calibration* tab to show the D/A channel manual calibration panel. Eight D/A channels are individually calibrated. Before calibrating, output desired voltage from the D/A channels and measure it through an external precision multi-meter.

Step 2: For example, choose channel 0; select the Range and select the wished output voltage code or value from the radio buttons (Fig. D-9).



Figure D-9: Selecting D/A Range

Step 3: According to the difference between the output voltage from D/A channel and the value in the multi-meter, adjust the gain, bipolar offset and unipolar offset registers (Fig. D-10)



Figure D-10: Adjusting registers

Step 4: Adjust registers until they fall between the output voltage from the D/A channel and the value in the multi-meter.